School Level

Probability

Probability में हमको बहुत सारी terminologies सीखना है, एक बार के हम यह सारी terminologies सीख गए तो हम questions करेंगे।

(i) Random Experiment :-

ऐसा experiment जिसमें एक ही event को बार बार perform करने पर different output मिले उसे Random Experiment कहते हैं।

eg: Tossing a coin, Throwing a dice, picking a card.

⇒ Random experiment किसी भी event का उसके पास एक list of possible outcomes होता है, उसी outcomes के अंदर randomness होगा।

e.g:- outcomes for event Tossing a coin — {H, T}
outcomes for event Throwing a dice → {1, 2, 3, 4, 5, 6}

(ii.) Sample Space :

Sample space वह टोकरी है जिसमें वह सारे outcomes रखे होते हैं जो उस event से आ सकते हैं।

e.g: Sample space for tossing a coin
{H, T}

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Throwing a dice → {1, 2, 3, 4, 5, 6}
Picking a card → 52 outcomes

Q write sample space for following events?

(i) I'm throwing a dice till a six comes out/ shows up.

इस event का sample space होगा

तो अगर तुम्हारा answer 6 or 5 or 1 है तो यह सारे answers गलत हैं।

तो कोशिश करते हैं इसका सही sample space निकालने का कोशिश करेंगे

पहली बार dice throw किया तो '6' आया
(या) first throw मे '1' आया और second throw मे '6' आया
(या) first throw मे '2' आया और second throw मे '6' आया
(या) first throw मे '3' आया और second throw मे '6' आया
वैसे ही (4,6), (5,6) आएगा।

लेकिन ये किसने बोला की दूसरी throw मे 6 आ जाएगा, अगर second throw मे 6 नही आता तो हमको

third बार dice फेंकना पड़ेगा
जैसे (1,1,6) आ सकते हैं, (1,2,6), (1,3,6), (1,4,6), (1,5,6) आ सकते हैं और अभी और भी तो आएगा (2,1,6) (2,2,6)
अब आपको लगभग question समझ में आया होगा, मैं आपसे फिर पूछता हूँ की इसके Sample space में कितना elements होगा → Infinite elements होगा।
तो third में outcome में 6 आना है तो मैं बहुत सारा elements लिख सकता हूँ इसके बाद मुझे क्या लिखना पड़ेगा fourth outcome में 6 आएं जैसे
(1,1,1,6), (1,1,2,6) (1,1,3,6) - - - -
(1,2,1,6), (1,2,2,6) (1,2,3,6) - - - -
ऐसा बहुत सारा outcomes आएगा।

(ii) event of throwing a dice if a '6' shows up then i will throw a coin otherwise i will throw the dice again.

Sample Space

{
(1,1) (1,2) (1,3) (1,4) (1,5) (1,6)
(2,1) (2,2) (2,3) (2,4) (2,5) (2,6)
(3,1) (3,2) (3,3) (3,4) (3,5) (3,6)
(4,1) (4,2) (4,3) (4,4) (4,5) (4,6)
(5,1) (5,2) (5,3) (5,4) (5,5) (5,6)
(6,H) (6,T)
}

This sample space will have '32' elements.

Sample space में दो तरह का sample space होते हैं :-

(i) Fundamental sample space
(ii) Derived sample space

For example के लिए लिया :-

Tossing two dice.

इसके लिए sample space होगा

S.S = { 11, 12, 13, 14, 15, 16 ...
21, 22, ------
⋮
61, 62, 63, ------, 66 }

↳ तो इस sample space में मेरे पास 36 outcomes है

⇒ अगर मान लो same experiment कर रहे हैं लेकिन हम sum of the outcomes of the two dice को observe कर रहे हो you are not observing the individual outcomes.

for example मैं दो dice को toss कर रहा हूँ यहाँ जो outcome होगा वो आपको दिखेगा नहीं obviously you are sitting far beyound where this experiment is happening.

so in order की आपको outcome दिखे मैं एक screen पर दो dice के outcome का sum display करदेता हूँ।

So, what are the possible outcomes तो sum जो है अगर outcome (1,1) है तो 2 आ सकते है, वैसे ही (1,2) है तो 3 आ सकते; (1,3) है तो 4 आ सकते; (1,4) है तो 5 आ सकते कहां तक जा सकते है 12 तक जा सकते है तो अपने हिसाब से what are the outcomes 2, 3, 4, upto... 12 तो हमारे लिए sample space क्या होगा यही होगा ना।

If only sum is being observed

$$= \{2, 3, 4, 5, \ldots\ldots, 12\}$$

अब question है कि पहली बार जब हम सिर्फ individual outcomes को consider कर रहे थे तो जो sample space आया और अब जब sum of the dice को as a outcome consider करके उसका sample space निकाला तो उसका जो sample space है निकला तो दोनो मे क्या difference है।

अब देखो

$S_1 = \{ (1,1), (1,2), (1,3), (1,4) (1,5), (1,6)$
(2,1)
⋮ $\}$

↳ यह एक fundamental sample space है

और

$S_2 = \{ 2, 3, 4, 5, \ldots \ldots 12 \}$
↳ Derived sample space

➜ अब मान लो कि मैं S_1 में ही हर एक element की individual possibility की बात करूं तो वह same होगा। i.e. all elements have equal likely to come. कैसे समझो, आपने bet किया कि (1,1) outcome आएगा और बगल वाला bet किया की (6,6) outcome आएगा; दोनों जीतने का probability same है या अलग-अलग है, same है ना क्योंकि जितना (1,1) आने का chance है; (6,6) आने का ही उतना ही chance है।

➜ लेकिन क्या S_2 sample space में possibility of every element is same होगा क्या ?

मान लिजिए one of you have placed your bet that sum 2 होगा, दूसरा आदमी bet किया की sum 7 होगा तो क्या दोनों का probability same है क्या

sum is 2 (1,1) → 1 outcome
Sum is 7 (1,6) (2,5) (3,4) → 6 outcomes
(4,3) (5,2) (6,1)

Clear; है की probability की sum 7 आए उसका ज्यादा होगा जब sum 2 आए उससे

इसका मतलब यह हो गया कि S_2 sample space के elements के आने की possibility is not equally likely.

In a nutshell :—

☆ Fundamental sample space :— मे elements के आने कि possibility (each) same / equally likely होती है।

☆ Derived sample space :— मे elements के आने कि possibility same नहीं / not equally likely होती है।

Event

→ event का physical meaning यह होता है कि "a happening on which you can place your bet"

→ usually probability deals with betting, most common use of probability is in betting.

→ मान लिजिए "event" is some happening on which bet can be placed.

e.x: एक event है throwing a dice.

इसके लिए sample space है
{1, 2, 3, 4, 5, 6}

अब time is for betting.

So what are different types of betting.?

जैसे
6 पर bet किया
5 पर bet किया
4 पर bet किया
3 पर bet किया
2 पर bet किया
1 पर bet किया

⋮

So what are the different ways you can bet each of them is called an event

so $E_1 = \{1\}$ → जब 1 पर betting कर रहे हैं

$E_2 = \{2\}$ → जब 2 पर betting कर रहे हैं

तो अब तुमको लग रहा होगा की इस event मे सिर्फ 1-6 यानी 6 तरीके से ही betting हो सकता है पर ऐसा जरूरी नही है क्योंकि even/odd no. पर भी तो कर सकते है वैसे ही बहुत तरीके से betting कर सकता हूं।

$E_3 = \{3\}$

$E_4 = \{2, 4, 6\}$

$E_5 = \{1, 3, 5\}$

$E_6 = \{2, 4, 5, 6\}$

So there can be different ways of betting; but sum of these bettings can be expressed in english also

देखिए जैसे E_4 की बात करे तो mathematically मे बोल सकता हूं की i am betting on $\{2, 4, 6\}$ पर english मे भी मैं बोल सकता।

है की i am betting on a even number
लेकिन E_6 को हम english मे नही बोल पाएंगे
तो कभी कभी english मे बोलना मुश्किल भी पड़ सकता है
इसलिए सबको english मे convert करना मुश्किल हो सकता है
that's why think mathematically यह बहुत महत्वपूर्ण बात है.

तो मान लो अगर मैं बोलूं तुमसे की i have placed my bet on $E_4 = \{2, 4, 6\}$.
तो मैं तुमको दो sentence बोलता हूं

(a) You have placed your bet on 2 (or) 4 (or) 6.

(b) You have placed your bet on 2 (and) 4 (and) 6.

'or' वाला सही है.
क्योंकि अगर 'and' वाला सही है तो मैं जब एक dice throw किया तो 2 भी आना चाहिए 4 भी आना चाहिए & 6 भी आना चाहिए

आ सकता है ऐसे एक dice throw करने पर तीनों 2, 4 & 6 आये नहीं आएगा ना!
या तो 2 आएगा (या) 4 आएगा (या) 6 आएगा।

इसलिए अगर मैं पूछूँ तुमसे की what is the meaning of event happening (let's say for E_4) तो उसका मतलब है की या तो 2 आए (या) 4 आए (या) 6 आए तो आप जीत जाओगे। i.e the event has happend.

event not happening का मतलब होगा की ना तो 2 आया ना 4 ना 6 आया।

तो event का मतलब क्या है?
Some happening on which bet can be placed.

लेकिन यह तो बहुत अजीब सा definition लग रहा है की event define करने के लिए betting क्यों करना है मुझे।

So what is the mathematical definition of event is:
⇒ a subset of Sample Space

तो अब हमें जानना है कि एक event में कितने elements हो सकते हैं।

i.e. No. of events $= 2^n$

where $n = n(S) \rightarrow$ no. of elements in sample space

तो अभी हमने देखा की यह events जो है वह sample space के subset होते हैं और हमने set theory chapter में पढ़ा था की एक set के 2^n subsets होंगे, where n is no. of elements in the set.

e.g; How many events are there for tossing a coin

a coin has two outcomes {H, T}

therefore,

No. of events $= (2)^2$

$= 4$ events.

एक बार देखिए tossing a coin के लिए sample space जो होगा {H, T}.

अब what are the possible events :-

तो हमको formulae से पता लगा कि 2^2 यानी 4 event होंगे।

Events → ϕ , {H}, {T}, {H, T}

तो पहला event होगा ϕ ; मैं ऐसा betting करता हूँ कुछ भी नहीं आएगा हो सकता है ऐसा कौन मना करता है मुझे हर बार हार जाएगा जैसे मैं betting house में गया और मैंने betting किया कि अगर कुछ नहीं आया तो मैं 10 हजार दूँगा।

दूसरा event होगा head आए।

तीसरा event होगा tail आए।

चौथा event होगा head और tail दोनों आएँ यानी कुछ भी आए तो मैं जीतूंगा यानी पूरा sample space में betting कर सकता हूँ।

तो थोड़ा सा अजीब लग रहा है इसलिए नामकरण कर देंगे & events को

ϕ ~~& {H, T}~~ → को बोलेंगे "Impossible event"

क्योंकी यह कभी नही होगा

{H, T} → को बोलेंगे "sure event" क्योंकी यह तो होना ही है अगर एक coin को toss करेंगे तो या तो head आएगा या tail आएगा।

और ϕ & {H, T} को combinedy बोलेंगे trivial event बोलेंगे very obvious क्योंकी हमको set theory से याद होगा की Subset के topic मे हमने पढ़ा था की empty set or set itself हर set का subset होता अगर यहां हम ध्यान दें तो ϕ यानी की impossible event और {H, T} यानी की sure event trivial event है।

और बाकी event sure & impossible event को छोड़ कर उनको non-trivial events बोलेंगे।

Non-Trivial events मे अब बहुत प्रकार के event होंगे जिसे हम types of events मे पढ़ेंगे।

Types of Events

① **Elementary or Simple Event :-**

ऐसा event जिसमे सिर्फ एक outcome आए।

(या) single element पर betting किया।

e.g: Throwing a dice

मे 1 पर betting किया (या)

2 पर ——— (या)

③ पर ———

so on... (4) (or) 5 (or) 6.

* Elementary event = $n(E) = 1$.

② **Compound or Mixed Event :-**

ऐसा event जिसमे एक से ज्यादा outcome आए।

(या) एक से ज्यादा element पर जब betting हो।

e.g: Throwing a dice

मे 2 (या) 3 पर betting किया

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③ Complementary Event :—

Represented by $\bar{E}$ (or) E^c (or) $\bar{E}$

या इसको बोलेंगे not E

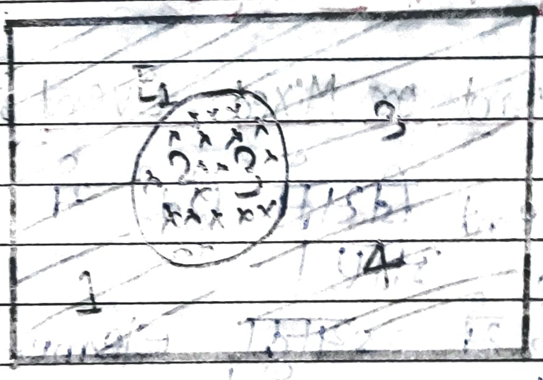
↳ Sample space − E

e.g.:

Sample space = {1, 2, 3, 4}

$E_1 = \{2, 3\}$

$\bar{E_1} = \{1, 3, 4\}$



→ Shows $\bar{E_1}$

→ Shows E_1

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(4) Mutually Exclusive events :—

देखिए अभी (3) तक event यानी single event का बात हो रहा था अब events हो गया यानी एक से ज्यादा event आ जाएंगे consideration में।

Two events are said to be exclusive if they don't have any intersection.

जब दो events के बीच कोई भी element common ना हो तो उसे Mutually exclusive events बोलेंगे।

e.g.: $E_1 = \{1, 2, 3\}$ $E_2 = \{5, 6\}$

$E_1 \cap E_2 = \phi$ so,

E_1 & E_2 are mutually exclusive events

* तीन events भी mutually exclusive हो सकते हैं; कभी-कभी questions में आएगा three events are pairwise mutually exclusive, इसका मतलब क्या है

$$E_1 \cap E_2 = \phi$$
$$E_2 \cap E_3 = \phi$$
$$E_1 \cap E_3 = \phi$$

(5.) Exhaustive Events :-

⇒ "exhaust" का मतलब होता है खत्म हो जाना।

If you have some no. event let's say $E_1, E_2, E_3, \ldots, E_n$ such that,

$$E_1 \cup E_2 \cup E_3 \ldots \cup E_n = S$$

where,
S ⇒ Sample Space

ये सारा events combine कर के अगर sample space आ जाए then such events are called "Exhaustive Events"; they are spread through complete sample space; इसका मतलब कि कोई भी outcome आया some of you will win.

ex: E_1 एक event है eg. {1, 2}
E_2 दूसरा event है eg. {2, 3}
S = {1, 2, 3, 4, 5, 6} E_3 तीसरा event है eg. {3, 4, 5}
E_4 चौथा event है {1, 6}

अब देखो ये चारो event मिल कर पूरा eg. sample space cover करता है।

Algebra of Events

① **E_1 and E_2 :-**

जब भी probability मे हम यह बोलेंगे कि E_1 and E_2 तो उसको ऐसे बोलेंगे :-
"$E_1 \cap E_2$".

② **Exactly one of E_1 or E_2 :-**

जब भी probability मे हम यह बोलेंगे कि exactly one of E_1 or E_2 तो उसका मतलब होता है कि
E_1 winning and E_2 not winning
(or) E_1 not winning and E_2 winning
तो उसको ऐसे बोलेंगे :-

$$``(E_1 \cap \overline{E_2}) \cup (\overline{E_1} \cap E_2)"$$

③ **E_1 but not E_2 :-**

जब भी probability मे हम यह बोलेंगे कि E_1 but not E_2 तो उसका मतलब होता है कि

$$``(E_1 \cap \overline{E_2})"$$

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④ Exactly one of E_1, E_2 or E_3 :—

probability में exactly one of E_1, E_2 or E_3 का मतलब होगा कि

E_1 wins and E_2 loses and E_3 losses (or)
E_1 losses and E_2 wins and E_3 loses (or)
E_1 loses and E_2 loses and E_3 wins.

इसका मतलब होगा :→

"$(\overline{E_1} \cap \overline{E_2} \cap \overline{E_3}) \cup (E_1 \cap \overline{E_2} \cap \overline{E_3}) \cup (\overline{E_1} \cap \overline{E_2} \cap E_3)$"

⑤ Neither E_1 nor E_2 :—

probability में neither E_1 nor E_2 का मतलब होगा कि

"$(\overline{E_1} \cap \overline{E_2})$"

Formulaes :—

☆ $P(E_1 \cup E_2) = P(E_1) + P(E_2)$; if $E_1 \cap E_2 = \phi$

देखिए ऊपर वाला formulae यह बोल रहा है कि $P(E_1 \cup E_2) = P(E_1) + P(E_2)$ तब होगा जब E_1 and E_2 are mutually exclusive.

* $P(\bar{E}) = 1 - P(E)$ {Complement Law}

जैसे मान लिजिए एक event का happening probability $\frac{1}{3}$ है, तो not happening probability कितना होगा $1 - \frac{1}{3} = \frac{2}{3}$. तो कोई event का

अगर probability पता है तो उसका not happening का probability आसानी से निकाल सकते हैं Complement Law के उपयोग से।

* $P(\bar{E_1} \cap \bar{E_2}) = P(\overline{E_1 \cup E_2}) = 1 - P(E_1 \cup E_2)$

$P(\bar{E_1} \cup \bar{E_2}) = P(\overline{E_1 \cap E_2}) = 1 - P(E_1 \cap E_2)$

{De-Morgan's Law}

→ इसका मतलब है probability of neither E_1 not happening nor E_2 not happening.

→ इसका मतलब है probability of either E_1 not happening or E_2 not happening.

✩ Odds in favour of E :-

Odds in favour of E का मतलब होता है

$$\text{odds in favour of } E = \frac{P(E)}{P(\bar{E})} = \frac{P(E)}{1 - P(E)}$$

i.e., probability of event happening divided by probability of event not happening.

✩ Odds ~~in~~ against E :-

Odds ~~in~~ ~~f~~ against of E का मतलब होता है

$$\text{odds against of } E = \frac{P(\bar{E})}{P(E)} = \frac{1 - P(E)}{P(E)}$$

i.e., probability of event not happening divided by probability of event happening.

Probability of an Event

मान लो कि एक bag में 90 red and 10 white balls हैं जो की shape and size में similar हैं।

अगर सब balls को मिला दिए और उसके बाद एक ball को draw किए at random तो वह या तो red होगा या white.

साफ बात है कि जो ball draw होगा उसकी red आने की संभावना ज्यादा है white से।

तो हम उसे ऐसे बोलेंगे की the event of drawing a red ball is more probable than the event of drawing a white ball.

जितने भी event जो random experiment से associated है हम कोशिश करेंगे कि एक numerical value उसके साथ जोड़ जिसे "probability" कहेंगे।

in such a manner that for any two events, the event which is more likely has a higher probability.

Probability of an Event

In a random experiment, let S be the sample space and let $E \subseteq S$. Then E is an event.

The probability of occurrence of E is defined as

$$P(E) = \frac{\text{no. of outcomes favourable to occurrence of } E}{\text{no. of all possible outcomes}}$$

$$= \frac{\text{no. of distinct elements in } E}{\text{no. of distinct elements in } S}$$

$$= \frac{n(E)}{n(S)}$$

$$\therefore \quad P(E) = \frac{n(E)}{n(S)}$$

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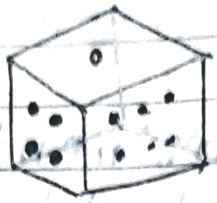
☆ Dice



- → A die is a solid cube
- → It has six faces that are marked with 1, 2, 3, 4, 5 and 6 dots.
- → In throwing a die, the outcome is the number of dots on the uppermost face.

☆ Playing Cards

	Clubs	Diamonds	Hearts	Spades
Ace	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1
8	1	1	1	1
9	1	1	1	1
10	1	1	1	1
Jack	1	1	1	1
Queen	1	1	1	1
King	1	1	1	1
	13 cards	13 cards	13 cards	13 cards

- A standards 52-card deck comprises

suits {
- clubs – 13 cards
- diamonds – 13 cards
- hearts – 13 cards
- spades – 13 cards

- Each suit includes an Ace, a King, Queen and Jack.

Results on Probability :–

Let S be the sample space & let E be an event. Then,

(i.) $P(E) \geq 0$

किसी भी event का probability अगर वह impossible event नहीं है तो zero से ज्यादा होगा कभी भी -ve नहीं होगा।

(ii.) $P(\phi) = 0$

impossible event का probability zero होता है।

(iii.) $P(S) = 1$

sure event का probability 1 होता है।

Addition Theorem

★ For any two events E_1 and E_2,

$$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

i.e.,

$$P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \text{ and } E_2)$$

★ For any three events E_1, E_2 & E_3.

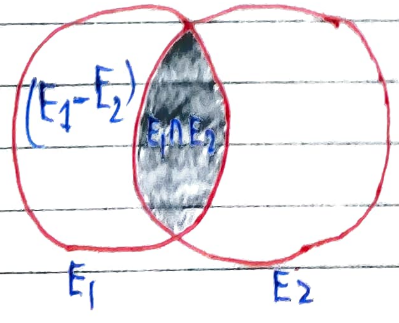
$$P(E_1 \cup E_2 \cup E_3) = P(E_1) + P(E_2) + P(E_3) - P(E_1 \cap E_2) - P(E_2 \cap E_3) - P(E_1 \cap E_3) + P(E_1 \cap E_2 \cap E_3)$$

NOTE:- If E_1 and E_2 are two mutually exclusive events then

$$P(E_1) + P(E_2) = 1$$

★ For any two compatible events E_1 and E_2,

$$P(E_1 - E_2) = P(E_1) - P(E_1 \cap E_2)$$



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★ If E_1 and E_2 be two events such that $E_1 \subseteq E_2$ then $P(E_1) \leq P(E_2)$.

Q. A die is thrown. Find the probability of :-

(i) getting a 5
(ii) getting a 2 or a 3
(iii) getting an odd number
(iv) getting a prime number
(v) getting a multiple of 3
(vi) getting a number between 3 and 6.

Ans

$S = \{1, 2, 3, 4, 5, 6\}$

Total no. of outcomes $= 6$

(i)

$$P(\text{getting a } 5) = \frac{\text{no. of outcomes favourable to getting a } 5}{\text{total no. of outcomes}}$$

$$= \frac{1}{6}$$

(ii)

P(getting a 2 or 3)

$$= \frac{\text{no. of outcomes favourable to getting a 2 or 3}}{\text{total no. of outcomes}}$$

$$= \frac{2}{6} = \frac{1}{3}$$

(iii.) P(getting an odd number)

$$= \frac{\text{no. of outcomes favourable to getting an odd number}}{\text{total no. of outcomes}}$$

$$= \frac{\cancel{2}}{\cancel{6}_3} = \frac{1}{3}$$

(iv.) P(getting a prime number)

$$= \frac{\text{no. of outcomes favourable to getting a prime number}}{\text{total no. of outcomes}}$$

$$= \frac{\cancel{3}}{\cancel{6}} = \frac{1}{2}$$

(V.) P(getting a multiple of 3)

$$= \frac{\text{no. of outcomes favourable to getting a multiple of 3}}{\text{total no. of outcomes}}$$

$$= \frac{\cancel{2}}{\cancel{6}} = \frac{1}{3}.$$

(vi.) getting a number between 3 and 6

अब देखो b/w 3 & 6 का मतलब होता है कि 3 और 6 के बीच 3 और 6 को छोड़कर i.e. 5 and 4.

P(getting a no. between 3 and 6)

$$= \frac{\text{no. of outcomes favourable to getting a no. b/w 3 \& 6}}{\text{total no. of outcomes}}$$

$$= \frac{2}{6} = \frac{1}{3}.$$

Q In a single throw of two dice, find the probability of :-

(i.) getting a sum less than 6

(ii.) getting a doublet of odd numbers.

(iii.) getting the sum as a prime number.

(P.T.O.)

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Ans: question में दिया है कि हमने दो dice को एक बार फेंका

Total no. of outcomes = 6×6 = 36 outcomes

(i) getting a sum less than 6

(1,4), (1,3), (1,2), (1,1)
(2,1), (2,2), (2,3), (3,2),
(3,2) (4,2)

} 10 outcomes favourable

P(getting a sum less than 6)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{10}{36} = \frac{5}{18}$

(ii) getting a doublet of odd numbers

"doublet" का मतलब होता है pair of two similar elements.

(1,1), (3,3), (5,5)

P(getting a doublet of odd numbers)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{3}{36} = \frac{1}{12}$

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(iii) getting the sum as a prime number

(1,1), (1,2), (1,4), (1,7)
(2,1), (2,3), (2,5)
(3,2), (3,4).
(4,1), (4,3)
(5,2), (6,1) (6,5)
(5,6)

15 favourable outcomes

P(getting the sum as a prime no.)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{15}{36} = \frac{5}{12}$

Q In a single throw of two dice, find:-

(i) P(an odd no. on the first die and a 6 on the second)
(ii) P(a number greater than 3 on each die)
(iii) P(a total of 10)
(iv) P(a total greater than 8)
(v) P(a total of 9 ~~or~~ ~~11~~)

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Ans: Sample space has = 6×6
= 36 outcomes

(i) Probability of an odd no. on the first die and a 6 on the second die

(1, 6), (3, 6), (5, 6) } 3 favourable outcomes.

P(getting an odd no. on the first die and a 6 on the second die)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{3}{36} = \frac{1}{12}$

(ii) Probability of getting a number greater than 3 on each die

(4, 4), (4, 5), (4, 6)
(5, 4), (5, 5), (5, 6)
(6, 4), (6, 5), (6, 6) } 9 favourable outcomes

P(getting a no. greater than 3 on each die)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{9}{36} = \frac{1}{4}$

(iii.) Probability of getting a total of 10

(4,6), (6,4), (5,5) } 3 favourable outcomes

P(getting a total of 10)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{3}{36} = \frac{1}{12}$$

(iv.) Probability of getting a total greater than 8

(3,6), (4,5), (4,6),
(5,4), (5,5), (5,6),
(6,3), (6,4), (6,5),
(6,6) } 10 favourable outcomes

P(getting a total greater than 8)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{10}{36} = \frac{5}{18}$$

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(V.) Probability of getting a total of 9 or 11

(3, 6), (4, 5), (5, 4), (6, 3) } 4 favourable outcomes

P(getting a total of 9 or 11)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{4}{36} = \frac{1}{9}.$$

Q. A bag contains 4 white and 5 black balls. A ball is drawn at random from the bag. Find the probability that the ball drawn is white.

Ans: (4 white balls) (5 black balls)

No. of ways of selecting one white ball out of 4 available white balls

$$= {}^4C_1 = 4$$

P(getting a ball drawn is white)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{4}{9}$$

Q. In a lottery, there are 10 prizes and 25 blanks. Find the probability of getting a prize.

Ans:

Total no. of outcomes

$= 10 + 25$

$n(S) = 35$

P(getting a prize)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{10}{35} = \frac{2}{7}$

Q. If there are 2 children in a family, find the probability that there is at least one boy in the family?

Ans:

Total outcomes

$= \{(B, B), (B, G), (G, B), (G, G)\}$

(first three: favourable outcomes)

(P.T.O.)

Sol.

P(at least one boy in the family)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{3}{4}$$

Q. Three unbiased coins are tossed once. Find the probability of getting

(i.) exactly two tails.
(ii.) exactly one tail
(iii.) at most 2 tail.
(iv.) at least 2 tail
(v.) at most 2 tail or at least 2 head.

Ans:

Total outcomes

= { (H,H,H) (H,H,T) (H,T,H)
(H,T,T) (T,H,H) (T,H,T)
(T,T,H) (T,T,T) }

(i) exactly two tails :-

favourable outcomes

= {(H,T,T), (T,H,T) (T,T,H)}

So,

P(exactly two tail(s))

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{3}{8}$$

(ii) exactly one tail :-

favourable outcomes

$= \{(H,H,T), (T,H,H)\}$

So, P(exactly ~~two~~ one tails)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{2}{8} = \frac{1}{4}$$

(iii) at most two tail :-

favourable outcomes :

$= \{(H,H,H), (H,H,T), (H,T,H), (H,T,T), (T,H,H), (T,H,T), (T,T,H)\}$

so, P(at most two tails)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{7}{8}$

(iv.) at least two tail :—

favourable outcomes

$= \{ (H,T,T), (T,H,T), (T,T,H)$
$(T,T,T) \}$

so, P(at least two tails)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{4}{8} = \frac{1}{2}$.

(V.) at most 2 tail or at least 2 head :—

favourable outcomes

$= \{ (H,H,H), (H,H,T), (H,T,H)$
$(T,H,H), \}$

So,

P(at most 2 tail or atleast 2 head)

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{4}{8} = \frac{1}{2}$$

Q. In a single throw of dice, determine the probability of not getting the same number on the two dice.

Ans:

total outcomes = 6 × 6
= 36 outcomes

= { (1, 1) (2, 2) (3, 3)
(4, 4) (5, 5) (6, 6) }

So,

P(getting same no. on two dice)

$$P(E) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{6}{36} = \frac{1}{6}$$

Now,

P(not getting same no. on the two dice)

$P(\overline{E}) = 1 - P(E)$

$= 1 - \frac{1}{6} = \frac{6-1}{6} = \frac{5}{6}$.

Q. If a letter is chosen at random from the English alphabet, find the probability that the letter chosen is :-
(i.) a vowel (ii.) a consonant

Ans: No. of letters in english alphabet = 26
$n(S) = 26$

(i.) a vowel

We know there are five vowels namely a, e, i, o, u, total 5 favourable outcomes

$P(\text{getting a vowel}) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{5}{26}$

(P.T.O.)

(ii) a consonant

we know there are 21 consonants.

P(getting a consonant)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{21}{26}$

Q. A card is drawn at random from a well-shuffled pack of 52 cards. What is the probability that the card bears a number greater than 3 and less than 10?

Ans: total outcomes = 52 cards

Numbers would be

↳ {4, 5, 6, 7, 8, 9} → (6)

And we know there are four suits

= 6 x 4

= 24 cards

∴ P(card bears a number greater than 3 and less than 10)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{\cancel{24}\ \cancel{12}\ 6}{\cancel{52}\ \cancel{26}\ 13} = \frac{6}{13}$

Q. Tickets numbered from 1 to 12 are mixed up together and then a ticket is withdrawn at random. Find the probability that the ticket has a number which is a multiple of 2 or 3.

Ans: n(S) = 12.

favourable outcomes

= {2, 4, 6, 8, 10, 12, 3, 9}. → total 8 outcomes

P(ticket has a number which is a multiple of 2 or 3)

$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

$= \frac{\cancel{8}\ \cancel{4}\ 2}{\cancel{12}\ 6} = \frac{2}{3}.$

Q. What is the probability that an ordinary year has 53 Tuesdays?

Ans:

No. of days in a year = 365

52 weeks + 1 days

अब एक week में 7 दिन होते हैं
इसलिए total outcomes / sample space होगा :—

$m(S) = 7$

तो हमे क्या चाहिए tuesday चाहिए है इसलिए no. of favourable outcomes होगा :—

$m(E) = 1$

Hence

P(of 53 tuesdays) — मतलब उस 7 दिन में 1 दिन tuesday का हो

$= \frac{1}{7}$

Q What is the probability that a leap year has 53 sundays ?

Ans:

No. of days in leap year = 366 → 52 week + 2 days

the remaing 2 days except 52 weeks can be like :—

{ [Mon, Tues.], [Tue., Wed.], [Wed., Thru.], [Thru., Fri.], [Fri., Sat.], [Sat., Sun.], [Sun., Mon.] }

तो इसका मतलब हुआ कि सात कुल favourable outcomes है।

तो हमें क्या चाहिए sunday चाहिए है इसलिए no. of favourable outcomes होगा :—

$n(E) = 1$.

Hence,

P(of 53 sundays)

$= \frac{2}{7}$.

Q. What is the probability that in a group of two people, both will have the same birthday, assuming that there are 365 days in a year and no one has his/her birthday on 29 February?

Ans: A & B are two peoples.

$m(S) = 365 \times 365$ → total outc.
$m(E) = 365$ → favourable outc.

Probability of getting both have the same birthday

$$P(E) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{365}{365 \times 365}$$

$$= \frac{1}{365}$$

Q. If $\frac{7}{10}$ is the probability of occurence of an event, what is the probability that it does not occur?

(P.T.O.)

Ans: Let the event to occur be 'E'

Probability of occurrence of an event

$P(E) = \frac{7}{10}$

Now,

probability that it does not occur

$P(\bar{E}) = 1 - \frac{7}{10} = \frac{3}{10}$

i.e. the probability that it does not occur

$= \frac{3}{10}$

Q. The odds in favour of the occurrence of an event are 8:13. Find the probability that the event will occur?

Ans:

∴ Odds in favour = $\frac{\text{no. of possibilities in favour}}{\text{no. of possibilities against.}}$

$= \frac{8}{13}$

So total no. of possibilities = 8 + 13

= 21.

$$P(E) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{8}{21}$$

Q. If the odds against the occurence of an event be 4 : 7, find the probability of the occurence of the event.

Ans: let, the probability of event is P(E)

∴ odd against favour occurence of event

$$\Rightarrow \frac{1 - P(E)}{P(E)}.$$

$$= \frac{4}{7}$$

$$\Rightarrow 7 - 7P(E) = 4P(E)$$

$$\Rightarrow 7 = 11 \cdot P(E)$$

$$\Rightarrow P(E) = \frac{7}{11}$$

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Hence, The probability of occurence of the event $= \frac{7}{11}$.

Q. If $\frac{5}{14}$ is the probability of occurence of an event. find :-

(i) the odds in favour of its occurence.
(ii) the odds against its occurence.

Ans:

Let the P(occurence of an event) be P(E)

$$P(E) = \frac{5}{14}$$

(i) the odds in favour of its occurence.

$$\text{odds in favour} = \frac{P(E)}{1 - P(E)}$$

$$= \frac{5/14}{1 - \frac{5}{14}}$$

$$= \frac{5/14}{\frac{9}{14}} = \frac{5}{9}$$

(P.T.O.)

(ii) the odds against its occurence

$$= \frac{1 - P(E)}{P(E)}$$

$$= \frac{1 - \frac{5}{14}}{5/14} = \frac{\frac{14-5}{14}}{\frac{5}{14}} = \frac{9}{5}$$

Q. Two dice are thrown. find the probability of

(i) the odds in favour of getting the sum 6.

(ii) the odds against getting the sum 7.

Ans:

क्योंकि, दो dice फेंके हैं इसलिए

total possibilities = 6×6

n(S) = 36.

(i) the odds in favour of getting sum 6

~~favourable~~

favourable outcomes for getting sum as 6

= {(1,5), (2,4), (3,3), (4,2), (5,1)}

P(getting a sum of 6) = $\frac{5}{36}$.

Odds in favour = $\frac{P(\text{getting sum of } 6)}{1 - P(\text{getting sum of } 6)}$

$= \frac{\frac{5}{36}}{1 - \frac{5}{36}} = \frac{5}{36-5} = \frac{5}{31}$.

(ii.) the odds against getting the sum 7

favourable outcomes for getting sum as 7

$= \{(1,6), (2,5), (3,4), (4,3), (5,2) (6,1)\}$

P(getting a sum of 7) $= \frac{6}{36} = \frac{1}{6}$.

Odds against getting the sum as 7

$= \frac{1 - P(\text{getting a sum of } 7)}{P(\text{getting a sum of } 7)}$

$= \frac{1 - \frac{1}{6}}{1/6} = \frac{\frac{6-1}{6}}{1/6} = 5$.

Q. A combination lock on a suitcase has 3 wheels, each labelled with nine digits from 1 to 9. If an opening combination is a particular sequence of three digits with no repeats, what is the probability of a person guessing the right combination?

Ans:

__ __ __

9 8 7

Total no. of lock possible

$= 9 \times 8 \times 7$

$= 72 \times 7$

$= 504$ combinations

Probability of a person guessing the right combination

$$= \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

$$= \frac{1}{504}$$

{∵ there should be only 1 combi. that is the correct lock key.}

Q. If E_1 and E_2 are two events associated with a random experiment such that $P(E_2) = 0.35$, $P(E_1 \text{ or } E_2) = 0.85$ and $P(E_1 \text{ and } E_2) = 0.15$, find $P(E_1)$.

Ans: माना लिया कि $P(E_1) = x$ तब,

$$P(E_1 \text{ or } E_2) = P(E_1) + P(E_2) - P(E_1 \text{ and } E_2)$$

$$\Rightarrow 0.85 = P(E_1) + 0.35 - 0.15$$
$$\Rightarrow 0.85 = x + 0.35 - 0.15$$
$$\Rightarrow x = 0.85 - 0.20$$
$$\Rightarrow x = 0.65$$

$$\therefore P(E_1) = 0.65$$

Q. Two dice are tossed together. Find the probability of getting a doublet or a total of 6.

Ans: जब दो dice को throw किए साथ में, तो $(6 \times 6) = 36$ outcomes मिलते हैं

Let S be the sample space.

$$n(S) = 36$$

माना लिया कि

E_1 = event of getting a doublet

E_2 = event of getting a total of 6.

तब

$E_1 = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

and $E_2 = \{(2,4), (3,3), (4,2)\}$

$\therefore (E_1 \cap E_2) = \{(3,3)\}$

इसलिए,

$m(E_1) = 6$; $m(E_2) = 3$

$m(E_1 \cap E_2) = 1$

$\therefore P(E_1) = \frac{m(E_1)}{m(S)} = \frac{6}{36} = \frac{1}{6}$

$P(E_2) = \frac{m(E_2)}{m(S)} = \frac{3}{36} = \frac{1}{12}$

and

$P(E_1 \cap E_2) = \frac{m(E_1 \cap E_2)}{m(S)} = \frac{1}{36}$

$\therefore$ P(getting a doublet or a total of 6)

$= P(E_1 \text{ or } E_2)$

$= P(E_1 \cup E_2)$

$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$

$= \left(\frac{1}{6} + \frac{1}{12} - \frac{1}{36}\right) = \frac{8}{36} = \frac{2}{9}$

इसलिए required probability होगा = $\frac{2}{9}$

Q. In a single throw of two dice, find the probability that neither a doublet nor a total of 10 will appear.

Ans: Let S be sample space.

तब $n(S) = 36$.

Let, E_1 = event that a doublet appears
& E_2 = event of getting a total of 10.

तब,

$E_1 = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

and

$E_2 = \{(4,6), (5,5), (6,4)\}$

$\therefore E_1 \cap E_2 = \{(5,5)\}$

Thus, $n(E_1) = 6$, $n(E_2) = 3$
$n(E_1 \cap E_2) = 1$

$\therefore P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

$$P(E_2) = \frac{m(E_2)}{m(S)} = \frac{3}{36} = \frac{1}{12}$$

अब,

$$P(E_1 \cap E_2) = \frac{m(E_1 \cap E_2)}{m(S)} = \frac{1}{36}$$

$\therefore$ P(getting a doublet or a total of 10)

$= P(E_1 \text{ or } E_2) = P(E_1 \cup E_2)$

$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$

$= \left(\frac{1}{6} + \frac{1}{12} - \frac{1}{36}\right) = \frac{8}{36} = \frac{2}{9}$

$\therefore$ P(getting neither a doublet nor a total of 10)

$= P(\overline{E_1} \text{ and } \overline{E_2})$

$= P(\overline{E_1} \cap \overline{E_2})$

$= P(\overline{E_1 \cup E_2})$

$= 1 - P(E_1 \cup E_2)$

$= 1 - \frac{2}{9} = \frac{9-2}{9} = \frac{7}{9}$.

इसलिए, Required probability is $\frac{7}{9}$.

Q. A natural number is chosen at random from among the first 500. What is the probability that the number so chosen is divisible by 3 or 5?

Ans: माना लिया 'S' be sample space.
तो साफ है कि $n(S) = 500$

माना लिया कि

E_1 = event of getting a no. divisible by 3
E_2 = event of getting a no. divisible by 5.

तब,
$(E_1 \cap E_2)$ = event of getting a no. divisible by both 3 and 5.

= event of getting a no. divisible by 15.

$\therefore E_1 = \{3, 6, 9, \ldots\ldots, 495, 498\}$

$E_2 = \{5, 10, 15, \ldots\ldots, 495, 500\}$

and

$(E_1 \cap E_2) = \{15, 30, 45, \ldots\ldots, 495\}$

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$$\therefore m(E_1) = \frac{498}{3} = 166,$$

$$m(E_2) = \frac{500}{5} = 100$$

and

$$P(E_1 \cap E_2) = \frac{495}{15} = 33$$

$$\therefore P(E_1) = \frac{m(E_1)}{m(S)} = \frac{166}{500} = \frac{83}{250},$$

$$P(E_2) = \frac{m(E_2)}{m(S)} = \frac{100}{500} = \frac{1}{5}$$

and

$$P(E_1 \cap E_2) = \frac{m(E_1 \cap E_2)}{m(S)} = \frac{33}{500}$$

$\therefore$ P(the chosen no. divisible by 3 or 5)

$$= P(E_1 \text{ or } E_2) = P(E_1 \cup E_2)$$

$$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

$$= \left(\frac{83}{250} + \frac{1}{5} - \frac{33}{500}\right)$$

$$= \frac{233}{500}$$

Hence, the reqd. probability is $\frac{233}{500}$

Q. A card is drawn at random from a well shuffled deck of 52 cards. Find the probability of its being a spade or a king.

Ans: मान लिया कि 'S' be the sample space

इसलिए $n(S) = 52$

मान लिया,

E_1 = event of getting a spade

E_2 = event of getting a king.

अब,

$(E_1 \cap E_2)$ = event of getting a king of spades.

Clearly, $n(E_1) = 13$, $n(E_2) = 4$. and

$$n(E_1 \cap E_2) = 1.$$

$$\therefore P(E_1) = \frac{n(E_1)}{n(S)} = \frac{13}{52} = \frac{1}{4},$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{52} = \frac{1}{13}.$$

and

$$P(E_1 \cap E_2) = \frac{n(E_1 \cap E_2)}{n(S)} = \frac{1}{52}$$

(P.T.O.)

$\therefore$ P(getting a spade or a king)

$= P(E_1 \text{ or } E_2)$

$= P(E_1 \cup E_2)$

$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$

{by the addition theorem for two events}

$= \left(\frac{1}{4} + \frac{1}{13} - \frac{1}{52}\right) = \frac{16}{52} = \frac{4}{13}$

Hence, the required probability

$= \frac{4}{13}$

Q. Two cards are drawn at random from a well-shuffled pack of 52 cards. What is the probability that either both are red or both are kings?

Ans: मान लिया कि S be the sample space तब,

$n(S) =$ 52 cards मे से 2 card को draw करना।

$= {}^{52}C_2$

मान लिया,

E_1 = event that both are red cards

& E_2 = event that both are kings.

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Let, $(E_1 \cap E_2)$ = event of getting 2 red Kings.

$m(E_1)$ = no. of ways of drawing 2 red cards out of 26 red cards

$= {}^{26}C_2$.

$m(E_2)$ = no. of ways of drawing 2 kings out of 4 kings.

$= {}^{4}C_2$.

$\therefore m(E_1 \cap E_2)$ = no. of ways of drawing 2 red kings out of 2 red kings.

$= {}^{2}C_2 = 1$.

$\therefore P(E_1) = \dfrac{m(E_1)}{m(S)} = \dfrac{{}^{26}C_2}{{}^{52}C_2}$;

$P(E_2) = \dfrac{m(E_2)}{m(S)} = \dfrac{{}^{4}C_2}{{}^{52}C_2}$

and,

$P(E_1 \cap E_2) = \dfrac{m(E_1 \cap E_2)}{m(S)} = \dfrac{1}{{}^{52}C_2}$

$\therefore$ P(drawing both red cards or both Kings)

$= P(E_1 \text{ or } E_2)$

$= P(E_1 \cup E_2)$

$$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

$$= \left(\frac{^{26}C_2}{^{52}C_2} + \frac{^{4}C_2}{^{52}C_2} - \frac{1}{^{52}C_2} \right)$$

$$= \frac{(^{26}C_2 + {^4C_2} - 1)}{^{52}C_2}$$

$$= \frac{325 + 6 - 1}{1326} = \frac{330}{1326}$$

$$= \frac{55}{221}$$

इसलिए,

required probability $= \frac{55}{221}$.

Q. A box contains 100 bolts and 50 nuts. It is given that 50% bolts and 50% nuts are rusted. Two objects are selected from the box at random. Find the probability that either both are bolts or both are rusted.

Ans: Total no. of objects $= (100 + 50)$
$= 150$

माना कि 'S' sample space है. तब,

$n(S)$ = no. of ways of selecting 2 objects out of 150

$= {}^{150}C_2$

No. of rusted objects.

$= (50\% \text{ of } 100) + (50\% \text{ of } 50)$
$= 50 + 25$
$= 75.$

मान लिया कि

E_1 = event of selecting 2 bolts out of 100 bolts.
E_2 = event of selecting 2 rusted objects out of 75 rusted objects.

$\therefore (E_1 \cap E_2)$ = event of selecting 2 rusted bolts out of 50 rusted bolts

$\therefore n(E_1)$ = number of ways of selecting 2 bolts out of 100

$= {}^{100}C_2.$

$\therefore n(E_2)$ = number of ways of selecting 2 rusted objects out of 75

$= {}^{75}C_2.$

$\therefore n(E_1 \cap E_2)$ = no. of ways of selecting 2 rusted bolts out of 50.

$^{50}C_2$

$\therefore P(E_1) = \frac{m(E_1)}{m(S)} = \frac{^{100}C_2}{^{150}C_2}$,

$P(E_2) = \frac{m(E_2)}{m(S)} = \frac{^{75}C_2}{^{150}C_2}$

and,

$P(E_1 \cap E_2) = \frac{m(E_1 \cap E_2)}{m(S)}$

$= \frac{^{50}C_2}{^{150}C_2}$

P(selecting both bolts or both rusted objs)

$= P(E_1 \text{ or } E_2)$

$= P(E_1 \cup E_2)$

$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$

$= \frac{^{100}C_2}{^{150}C_2} + \frac{^{75}C_2}{^{150}C_2} - \frac{^{50}C_2}{^{150}C_2}$

$= \frac{^{100}C_2 + {^{75}C_2} - {^{50}C_2}}{^{150}C_2}$

$= \frac{4950 + 2775 - 1225}{11175}$

$= \frac{6500}{11175} = \frac{260}{447} = 0.58$

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Hence, the required probability = 0.58

Q. If E_1 and E_2 are two events such that $P(E_1) = 0.5$, $P(E_2) = 0.3$ and $P(E_1 \text{ and } E_2) = 0.1$, find?

(i.) $P(E_1 \text{ or } E_2)$
(ii.) $P(E_1 \text{ but not } E_2)$
(iii.) $P(E_2 \text{ but not } E_1)$
(iv.) $P(\text{neither } E_1 \text{ nor } E_2)$

Ans: हमारे पास है:

$P(E_1) = 0.5$, $P(E_2) = 0.3$
$P(E_1 \cap E_2) = 0.1$.

$\therefore P(\overline{E_1}) = 1 - P(E_1)$
$= 1 - 0.5$
$= 0.5$

and,

$P(\overline{E_2}) = 1 - P(E_2)$
$= 1 - 0.3$
$= 0.7$

अब

(i.) $P(E_1 \text{ or } E_2)$

$= P(E_1 \cup E_2)$
$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$
$= 0.5 + 0.3 - 0.1$
$= 0.7$

(ii) P(E_1 but not E_2)

$= P(E_1 \cap \bar{E_2})$

$= P(E_1) - P(E_1 \cap E_2)$

$= 0.5 - 0.1$

$= 0.4$.

(iii) P(E_2 but not E_1)

$= P(E_2 \cap \bar{E_1})$

$= P(E_2) - P(E_2 \cap E_1)$

$= 0.3 - 0.1$

$= 0.2$

(iv) P(neither E_1 nor E_2)

= P(not E_1 and not E_2)

$= P(\bar{E_1} \cap \bar{E_2})$

$= P(\overline{E_1 \cup E_2})$

$= 1 - P(E_1 \cup E_2)$

= 1 − P(E_1 or E_2)

$= 1 - 0.7$

$= 0.3$

Q. The probability that at least one of the events E_1 and E_2 occurs is 0.6. If the probability of the simultaneous occurrence of E_1 and E_2 is 0.2, find $P(\overline{E_1}) + P(\overline{E_2})$

Ans: दिया हुआ है कि

$$P(E_1 \cup E_2) = 0.6 \text{ and}$$
$$P(E_1 \cap E_2) = 0.2$$

$$\therefore P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$$

$$\Rightarrow P(E_1 \cup E_2) + P(E_1 \cap E_2) = P(E_1) + P(E_2)$$

$$\Rightarrow 0.6 + 0.2 = P(E_1) + P(E_2)$$

$$\Rightarrow P(E_1) + P(E_2) = 0.8$$

$$\Rightarrow \{1 - P(\overline{E_1})\} + \{1 - P(\overline{E_2})\} = 0.8$$

$$\Rightarrow P(\overline{E_1}) + P(\overline{E_2}) = 1.2$$

Q. The probabilities of the occurrences of two events E_1 and E_2 are 0.25 and 0.50 respectively. The probability of their simultaneous occurrence is 0.14. Find the probability that neither E_1 nor E_2 occurs.

दिया हुआ है कि

$P(E_1) = 0.25$

$P(E_2) = 0.50$

and $P(E_1 \text{ and } E_2) = P(E_1 \cap E_2)$

$= 0.14$

अब

$P(\overline{E_1}) = 1 - P(E_1)$

$= 1 - 0.25$

$= 0.75$

$P(\overline{E_2}) = 1 - P(E_2)$

$= 1 - 0.50$

$= 0.50$

$\therefore P(\text{neither } E_1 \text{ nor } E_2)$

$= P(\text{not } E_1 \text{ and not } E_2)$

$= P(\overline{E_1} \cap \overline{E_2})$

$= P(\overline{E_1 \cup E_2})$

$= 1 - P(E_1 \cup E_2)$

$= 1 - \{P(E_1) + P(E_2) - P(E_1 \cap E_2)\}$

$= 1 - (0.25 + 0.50 - 0.14)$

$= 1 - 0.61$
$= 0.39.$

Hence, the required probability is 0.39.

Q. A card is drawn from a deck of 52 cards. Find the probability of getting a king or a heart or a red card.

Ans: मान लिया कि 'S' sample space है।
अतः, $n(S) = 52$

मान लिए कि E_1, E_2 & E_3 be the events of getting a king, a heart and a red card respectively. Then,

$n(E_1) = 4$
$n(E_2) = 13$
$n(E_3) = 26$

$(E_1 \cap E_2)$ = event of getting a king of hearts,
$(E_2 \cap E_3)$ = event of getting a heart
$(E_3 \cap E_1)$ = event of getting a red king.

[∵ a heart is a red card also;]

and $(E_1 \cap E_2 \cap E_3)$ = event of getting a king of hearts.

$\therefore m(E_1 \cap E_2) = 1$

$m(E_2 \cap E_3) = 13$

$m(E_3 \cap E_1) = 2$

and

$m(E_1 \cap E_2 \cap E_3) = 1$

$\therefore P(E_1) = \frac{m(E_1)}{m(S)} = \frac{4}{52} = \frac{1}{13}$;

$P(E_2) = \frac{m(E_2)}{m(S)} = \frac{13}{52} = \frac{1}{4}$;

$P(E_3) = \frac{m(E_3)}{m(S)} = \frac{26}{52} = \frac{1}{2}$;

$P(E_1 \cap E_2) = \frac{m(E_1 \cap E_2)}{m(S)} = \frac{1}{52}$;

$P(E_2 \cap E_3) = \frac{m(E_2 \cap E_3)}{m(S)} = \frac{13}{52} = \frac{1}{4}$,

$P(E_3 \cap E_1) = \frac{m(E_3 \cap E_1)}{m(S)} = \frac{2}{52} = \frac{1}{26}$

&

$P(E_1 \cap E_2 \cap E_3) = \frac{m(E_1 \cap E_2 \cap E_3)}{m(S)} = \frac{1}{52}$

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$\therefore$ P(getting a King or a heart or a red card)

$= P(E_1 \text{ or } E_2 \text{ or } E_3)$
$= P(E_1 \cup E_2 \cup E_3)$
$= P(E_1) + P(E_2) + P(E_3) - P(E_1 \cap E_2) - P(E_2 \cap E_3) - P(E_3 \cap E_1) + P(E_1 \cap E_2 \cap E_3)$

$= \left(\frac{1}{13} + \frac{1}{4} + \frac{1}{2} - \frac{1}{52} - \frac{1}{4} - \frac{1}{26} + \frac{1}{52}\right)$

$= \frac{28}{52} = \frac{7}{13}.$

Hence, the required probability is $\frac{7}{13}$.

Q. If A and B are two events associated with a random experiment for which $P(A) = 0.60$, $P(A \text{ or } B) = 0.85$ and $P(A \text{ and } B) = 0.42$, find $P(B)$

Ans: given

$P(A) = 0.60$
$P(A \text{ or } B) = 0.85$
$P(A \text{ and } B) = 0.42$

हमको निकालना है P(B), इसलिए formulae लगाएँ :-

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

Values को रखने पर :-

$0.85 = 0.60 + P(B) - 0.42$
$0.85 = 0.18 + P(B)$
$0.85 - 0.18 = P(B)$
$P(B) = 0.67$

$\therefore P(B) = 0.67$

Q. Let A and B be two events associated with a random experiment for which $P(A) = 0.4$, $P(B) = 0.5$ and $P(A \text{ or } B) = 0.6$, find $P(A \text{ and } B)$.

Ans: दिया हुआ है कि

$P(A) = 0.4$
$P(A \text{ or } B) = 0.6$
$P(B) = 0.5$

हमें निकालना है $P(A \text{ and } B) = ?$

तो हम यहाँ पर formulae लगाएँगे

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\Rightarrow 0.6 = 0.4 + 0.5 - P(A \text{ and } B)$
$\Rightarrow 0.6 = 0.9 - P(A \text{ and } B)$
$\Rightarrow P(A \text{ and } B) = 0.9 - 0.6$

$\therefore P(A \text{ and } B) = 0.3$

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① In a random experiment, let A and B be events such that P(A or B) = 0·7, P(A and B) = 0·3 and $P(\bar{A}) = 0·4$. Find P(B).

Ans: दिया हुआ है कि

$$P(\bar{A}) = 0·4$$
$$P(A \text{ or } B) = 0·7$$
$$P(A \text{ and } B) = 0·3$$

हमें निकालना है कि P(B) क्या होगा

$$\because P(\bar{A}) = 0·4$$

$$P(A) = 1 - P(\bar{A})$$ $\left\{ \because P(A) = 1 - P(\bar{A}) \right\}$

$$= 1 - 0·4$$
$$= 0·6$$

Using the formulae :—

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\Rightarrow 0·7 = 0·6 + P(B) - 0·3$$
$$\Rightarrow 0·7 = 0·3 + P(B)$$
$$\Rightarrow P(B) = 0·4$$

$$\therefore P(B) = 0·4$$

(P.T.O.)

Q. If A and B be two events associated with a random experiment such that $P(A) = 0.25$, $P(B) = 0.4$ and $P(A \text{ or } B) = 0.5$, find the values of :-

(i) P(A and B)
(ii) P(A and $\overline{B}$)

Ans: (i) दिया हुआ है कि

$P(A) = 0.25$
$P(B) = 0.4$
$P(A \text{ or } B) = 0.5$

हमें निकालना है P(A and B)

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

सारा values को रखे तो, मिला

$\Rightarrow 0.5 = 0.25 + 0.4 - P(A \text{ and } B)$
$\Rightarrow 0.5 = 0.65 - P(A \text{ and } B)$
$\Rightarrow P(A \text{ and } B) = 0.65 - 0.5$
$\Rightarrow P(A \text{ and } B) = 0.15$
$\Rightarrow P(A \text{ and } B) = 0.15.$

(P.T.O.)

(ii) $P(A) = 0.25$, $P(A \text{ and } B) = 0.15$

तो हमें निकालना है कि $P(A \text{ and } \bar{B})$

$\because P(A \text{ and } \bar{B}) = P(A) - P(A \text{ and } B)$

$P(A \text{ and } \bar{B}) = 0.25 - 0.15$

$= 0.10$

Q. If A and B be two events associated with a random experiment such that $P(A) = 0.3$, $P(B) = 0.2$ and $P(A \cap B) = 0.1$, find

(i) $P(\bar{A} \cap B)$ (ii) $P(A \cap \bar{B})$

Ans (i) दिया हुआ है कि :-

$P(A) = 0.3$

$P(B) = 0.2$

$P(A \cap B) = 0.1$

हमको निकालना है $P(\bar{A} \cap B)$

$\because P(\bar{A} \cap B) = P(B) - P(A \cap B)$

$\Rightarrow P(\bar{A} \cap B) = 0.2 - 0.1$

$\Rightarrow P(\bar{A} \cap B) = 0.1$

(P.T.O.)

(ii.) दिया हुआ है कि :-

$P(A) = 0.3$
$P(B) = 0.2$
$P(A \cap B) = 0.1$

हमें निकालना है $P(A \cap \bar{B})$

$\because P(A \cap \bar{B}) = P(A) - P(A \cap B)$

$\Rightarrow P(A \cap \bar{B}) = 0.3 - 0.1$

$\Rightarrow P(A \cap \bar{B}) = 0.2$

Q. If A and B are two mutually exclusive events such that $P(A) = 1/2$ and $P(B) = 1/3$, find $P(A \text{ or } B)$.

Ans: दिया हुआ है कि A और B mutually exclusivents हैं।

$P(A) = \frac{1}{2}$ $P(B) = \frac{1}{3}$

हमे निकालना है $P(A \text{ or } B)$

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

हमको पता है कि Mutually ~~exclusivents~~ exclusive events के लिए $P(A \text{ and } B) = 0$ होता है।

$P(A \text{ or } B) = \frac{1}{2} + \frac{1}{3}$

$P(A \text{ or } B) = \frac{3+2}{6} = \frac{5}{6}$.

Q. Let A and B be two mutually exclusive events of a random experiment such that P(not A) = 0.65 and P(A or B) = 0.65, find P(B).

Ans: दिया हुआ है कि

A और B दो mutually exclusive events.

$P(\text{not } A) = P(\bar{A}) = 0.65$.

$P(A \text{ or } B) = 0.65$

अब हमें निकालना है P(B)

$\because P(A) = 1 - P(\bar{A})$

$P(A) = 1 - 0.65$

$P(A) = 0.35$

$\because P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\Rightarrow 0.65 = 0.35 + P(B) - P(A \cap B)$

For Mutually exl. events A & B ; $(A \cap B) = 0$

$\Rightarrow 0.65 = 0.35 + P(B)$

$\Rightarrow P(B) = 0.65 - 0.35$

$= 0.30$

$\therefore P(B) = 0.30$

Q. A, B, C are three mutually exclusive and exhaustive events associated with a random experiment. If
~~P(B) = 3/2 , P(A) and C = ...~~
$P(B) = (3/2) \cdot P(A)$ and
$P(C) = (1/2) \cdot P(B)$, find $P(A)$.

Ans: दिया हुआ है कि A, B, C mutually exclusive events & exhaustive events.

$P(B) = (3/2) \cdot P(A)$
$P(C) = (1/2) \cdot P(B)$

हमें निकालना है कि P(A) क्या होगा

Mutually exclusive events A, B & C के लिए

$P(A \text{ and } B) = P(B \text{ and } C) = P(A \text{ and } C) = 0$

मान लिया कि $P(A) = x$

Now,

$P(B) = \frac{3}{2} \cdot x$ } $P(C) = \frac{1}{2} \times \frac{3}{2} x$

$= \frac{3}{4} x$

Since,

$P(A) + P(B) + P(C) = 1$

(P.T.O.)

putting values, we get :

$$\Rightarrow x + \frac{3}{2}x + \frac{1}{2} \times \frac{3}{2} \times x = 1$$

$$\Rightarrow x + \frac{3}{2}x + \frac{3}{4}x = 1$$

$$\Rightarrow \frac{4x + 6x + 3x}{4} = 1$$

$$\Rightarrow 13x = 4$$

$$\Rightarrow x = \frac{4}{13}$$ इसलिए, $P(A) = \frac{4}{13}$

Q. The probability that a company executive will travel by plane is (2/5) and that he will travel by train is (1/3). Find the probability of his travelling by plane or train.

Ans:
माना कि
'A' denote the event that a company executive will travel by plane.

'B' denote the event that he travels by train.

दिया हुआ है कि

$$P(A) = \frac{2}{5}, \quad P(B) = \frac{1}{3}$$

हमें निकालना है probability of a company executive will be travelling by plane or train

$= P(A \text{ or } B)$

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

तो समझो यहाँ की

probability of a company executive will be travelling in both plane and train.

$= P(A \text{ and } B) = 0$

क्योंकी वह plane और train पर एक समय पर सफर नहीं कर सकता है!

$P(A \text{ or } B) = \frac{2}{5} + \frac{1}{3} - 0$

$= \frac{6+5}{15} = \frac{11}{15}$

Hence,

Probability of a company executive will be travelling by plane or train

$= P(A \text{ or } B) = \frac{11}{15}$

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Q. From a well shuffled pack of 52 cards, a card is drawn at random. Find the probability of its being a king or queen.

Ans. मान लिया कि,
A denote the event that card drawn is king.
B denote the event that card drawn is queen.

एक pack of 52 cards में 4 kings एवं 4 queen cards होते हैं

दिया हुआ है कि

$$P(A) = \frac{4}{52} \qquad P(B) = \frac{4}{52}$$

हमें निकालना है कि
probability that card drawn is king or queen
$= P(A \text{ or } B)$

$\because$ Probability $= \dfrac{\text{favourable no. of outcomes}}{\text{total no. of outcomes}}$

क्योंकि

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$P(A) = \frac{4}{52}$ {क्योंकि favourable no. of outcomes $= 4$ & total no. of outcomes $= 52$}

$P(B) = \frac{4}{52}$ {क्योंकि favourable no. of outc. $= 4$ & total no. of outcomes $= 52$}

तो,

probability that card drawn is King or queen = P(A and B) = 0

क्योंकि एक card same time पर King और queen दोनों नहीं हो सकते

$$P(A \text{ or } B) = \frac{4}{52} + \frac{4}{52} - 0$$

$$P(A \text{ or } B) = \frac{4+4}{52} = \frac{8}{52} = \frac{2}{13}$$

$$P(A \text{ or } B) = \frac{2}{13}$$

∴ Probability of a card drawn is King or queen

$$= P(A \text{ or } B) = \frac{2}{13}$$

Q. From a well-shuffled pack of cards, a card is drawn at random. Find the probability of its being either a queen or a heart.

(P.T.O.)

Ans: माना लिया कि
A denote the event that the card drawn is queen. &

B denote the event that the card drawn is heart.

एक pack of 52 Cards में 4 queen cards होते हैं एवं 13 heart cards होते हैं।

दिया हुआ है कि

$$P(A) = \frac{4}{52}, \quad P(B) = \frac{13}{52}$$

हमें निकालना है कि Probability that card drawn is either a queen or heart.

$= P(A \text{ or } B)$

{ ∵ $\text{probability} = \dfrac{\text{favourable no. of outcomes}}{\text{total no. of outcomes}}$ }

इसलिए,

$P(A) = \frac{4}{52}$ { क्योंकि favourable no. of outcomes = 4 & total no. of outcomes = 52 }

$P(B) = \frac{13}{52}$ { क्योंकि favourable no. of outcomes = 13 & total no. of outcomes = 52 }

Probability that card drawn is both queen and heart
= P(A and B) = 1

{ क्योंकी यहाँ सिर्फ एक ही कोई ऐसा है जो queen & heart दोनो है यानी queen of hearts }

$$P(A \text{ or } B) = \frac{4}{52} + \frac{13}{52} - 1$$

$$P(A \text{ or } B) = \frac{4+13-1}{52} = \frac{16}{52} = \frac{4}{13}$$

Hence,

Probability of a card drawn is either a queen or heart

= P(A or B)

$$= \frac{4}{13}$$

Q. A card is drawn at random from a well-defined deck of 52 cards. Find the probability of its being a spade or a king.

(P.T.O.)

Ans: माना लिया कि

A denote the event that the card drawn is spade.

B denote the event that card drawn is King.

एक 52 कार्ड्स के pack में 13 spade cards और 4 King cards होते हैं

दिया हुआ है कि :—

$$P(A) = \frac{13}{52}, \quad P(B) = \frac{4}{52}$$

हमें निकालना है कि Probability that card drawn is either a queen or heart.

$= P(A \text{ or } B)$

$$\left\{ \because \text{Probability} = \frac{\text{favourable no. of outcomes}}{\text{total no. of outcomes}} \right\}$$

$P(A) = \frac{13}{52}$ {as favourable no. of outcomes = 13 & total no. of outcomes = 52}

$P(B) = \frac{4}{52}$ {as favourable no. of outcomes = 4 & total no. of outcomes = 52}

The probability that card is drawn is both spade and king

$= P(A \text{ and } B)$

$= 1$

{क्योंकी एक card है जिसमें both Spade & King i.e. King of spades}

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\Rightarrow P(A \text{ or } B) = \frac{13}{52} + \frac{4}{52} - 1$

$\Rightarrow P(A \text{ or } B) = \frac{16}{52} = \frac{4}{13}$

Hence,

Probability of a card drawn is either a spade or king

$= P(A \text{ or } B)$

$= \frac{4}{13}$

Q. A number is chosen from the numbers 1 to 100. Find the probability of its being divisible by 4 or 6.

Ans. मान लिया

A denote the event that the no. is divisible by 4.

B denote the event that the no. is divisible by 4.

हमें निकालना है probability that the number is both divisible by 4 or 6

= P(A or B)

∴ probability = $\frac{\text{favourable no. of outcomes}}{\text{total no. of outcomes}}$

~~P(A or B) = P~~

Numbers from 1 to 100 divisible by 4 are 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100

1 से 100 के बीच 25 ऐसे no.s हैं जो 4 से divisible होंगे।

1 से 100 के बीच 16 no.s होंगे जो 6 से divisible होंगे।

favourable no. of outcomes = 16

इसलिए,

favourable no. of outcomes = 16

Total no. of outcomes = 100

क्योंकि 1 से 100 तक 100 नंबर्स है।

$$P(B) = \frac{16}{100}$$

Numbers from 1 to 100 divisible by both 4 and 6 are 12, 24, 36, 48, 60, 72, 84, 96.

1 से 100 के बीच 8 numbers है जो 4 & 6 दोनों से divisible होगा।

Favourable no. of outcomes = 8

$$P(A \text{ and } B) = \frac{8}{100}$$

$$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$= \frac{25}{100} + \frac{16}{100} - \frac{8}{100}$$

$$= \frac{25+16-8}{100} = \frac{33}{100}$$

The probability that the no. is both divisible by 4 or 6

$= P(A \text{ or } B) = \frac{33}{100}$

Q A die is thrown twice. What is the probability that at least one of the two throws comes up with the number 4?

Ans: दिया गया है कि एक dice को फेंके

हमें find करना है कि probability that at least one of the two throws comes up with the number 4

$\therefore$ probability $= \frac{\text{favourable outcomes}}{\text{total outcomes}}$

A die is numbered from 1 to 6.

जब एक die को दो बार throw किए तो,

total no. of outcomes $= 6^2 = 36$

Favourable outcomes =

$\{(4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (1,4), (2,4), (3,4), (5,4), (6,4)\}$

Favourable no. of outcomes = 11

Probability that at least one of the two throws comes up with the number 4

$= \frac{11}{36}$.

The probability that at least one of the two throws comes up with the number 4

$= \frac{11}{36}$.

Q. Two dice are tossed once. Find the probability of getting an even no. on the first die or a total of 8.

Ans: दिया गया है कि दो dice को एक बार toss किया।

हमे निकालना है Probability of getting an even number on the first die or a total 8.

A die is numbered from 1 to 6
जब दो dice को एक बार toss करेंगे तो,

total no. of outcomes = $6^2 = 36$

मान लिया
A denote the event of getting an even number on the first die and

B denote the event of getting a total of 8

For getting an even no. on the first die

favourable outcomes =
{(2,1), (2,2), (2,3), (2,4), (2,5), (2,6),
(4,1), (4,2), (4,3), (4,4), (4,5),
(4,6), (6,1), (6,2), (6,3), (6,4),
(6,5), (6,6)}

Favourable no. of outcomes = 18

Probability of getting an even no. on the first die

$= P(A) = \frac{18}{36}$

For getting a total of 8:

Favourable outcomes =

$\{(2,6), (4,4), (6,2), (5,3), (3,5)\}$

favourable outcomes = 5

Probability of getting a total of 8

$= P(A) = \frac{5}{36}$.

For getting an even number on the first die and a total of 8:

favourable outcomes

$= \{(2,6), (4,4), (6,2)\}$

Probability of getting an even number on the first die and a total of 8

$= P(A \text{ and } B)$

$= \frac{3}{36}$

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$P(A \text{ or } B) = \frac{18}{36} + \frac{5}{36} - \frac{3}{36}$

$P(A \text{ or } B) = \frac{18+5-3}{36} = \frac{20}{36} = \frac{5}{9}$

Probability of getting an even no. on the first die or a total 8

$= \frac{5}{9}$

Q. Two dice are thrown together. what is the probability that the sum of the numbers on the two faces is neither divisible by 3 nor by 4.

Ans: दिया गया है कि दो dice को throw किए

Sample Space:

(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(5,2)	(6,3)	(6,4)	(6,5)	(6,6)

तो, इसको निकालना है

P(sum of faces neither divisable by 3 nor by 4)

Sum = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}

Sum neither divisible by 3 nor 4

= {2, 3, 5, 7, 10, 11}

$$P = \frac{\text{no. of favourable outcomes}}{\text{total outcomes}}$$

P(sum of faces neither divisible by 3 nor by 4)

$$= \frac{5}{11}$$

$\therefore$ probability $= \frac{5}{11}$.

Q. In a class, 30% of the students offered mathematics, 20% offered chemistry and 10% offered both. If a student is selected at random, find the probability that he has offered mathematics or chemistory.

Ans: दिया गया है :—

Math students = 30%
Chemistry students = 20%

Math & Chemistry both = 10%

हमको निकालना है, P(Math or Chemistry)

अतः

$P(\text{math}) = 30\% = \frac{30}{100} = 0.30$

$P(\text{Chemistry}) = 20\% = \frac{20}{100} = 0.20$

$P(\text{Math} \cap \text{Chemistry}) = 10\% = \frac{10}{100} = 0.10$

we know that,

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\therefore P(\text{Math} \cup \text{Chemistry})$

$= 0.30 + 0.20 - 0.10$
$= 0.40$

Hence,

number of students studying math or chemistry are 40%.

Q. The probability that Hemant passes in English is (2/3), and the probability that he passes in Hindi is (5/9). If the probability of his passing both the subjects is (2/5), find the probability that he will pass in at least one of these subjects.

Ans: माना लिया कि :-

'A' → denotes the event that Hemant passes in english

'B' → denotes the event that Hemant passes in hindi

दिया हुआ कि है :-

$P(A) = \frac{2}{3}$, $P(B) = \frac{5}{9}$

$P(A \text{ and } B) = \frac{2}{5}$

इसको निकालना है;

probability that he will pass in at least one of these subjects

$= P(A \text{ or } B)$

$\{\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)\}$

$$P(A \text{ or } B) = \frac{2}{3} + \frac{5}{9} - \frac{2}{5}$$

$$P(A \text{ or } B) = \frac{30 + 25 - 18}{45} = \frac{37}{45}$$

$$P(A \text{ or } B) = \frac{37}{45}.$$

Hence,

The probability that she will pass in at least one of these subjects

$$= P(A \text{ or } B)$$

$$= \frac{37}{45}.$$

Q. The probability that a person will get an electrification contract is a(2/5) and the probability that he will not get a plumbing contract is (4/7). If the probability of getting at least one contract is (2/3), what is the probability that he will get both?

(P.T.O.)

Ans: मान लिया किया

'A' denote the event that a person will get electrification contract.

'B' denote the event that a person will get a plumbing contract.

दिया गया है कि :-

$P(A) = \frac{2}{5}$, $P(\text{not } B) = P(\bar{B}) = \frac{4}{7}$

$P(A \text{ or } B) = \frac{2}{3}$.

हमें निकालना है;

Probability that he will get both electrification and plumbing contract $= P(A \text{ and } B)$

$\because P(B) = 1 - P(\bar{B})$

$P(B) = 1 - \frac{4}{7} = \frac{7-4}{7} = \frac{3}{7}$

$P(A \text{ or } B) =$ probability of getting at least one contract

$= \frac{2}{3}$

$\because P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\Rightarrow \frac{2}{3} = \frac{2}{5} + \frac{3}{7} - P(A \text{ and } B)$

$\Rightarrow P(A \text{ and } B) = \frac{29}{35} - \frac{2}{3}$

$\Rightarrow P(A \text{ and } B) = \frac{17}{105}$

The probability that he will get both electrification and plumbing contract

$= \frac{17}{105}$

Q. The probability that a patient visiting a dentist will have a tooth extracted is 0·06, the probability that he will have a cavity filled is 0·2, and the probability that he will have a tooth extracted or a cavity filled is 0·23. What is the probability that he will have a tooth extracted as well as a cavity filled?

Ans: मान लिया कि

'A' denote the event that a patient visiting a dentist will have a tooth extracted &

"B" denote the event that a patient will have a cavity filled.

दिया गया है कि :-

$P(A) = 0.06$
$P(B) = 0.2$
$P(A \text{ or } B) = 0.23$

हमको निकालना है Probability that he will have a tooth extracted and a cavity filled
$= P(A \text{ and } B)$

Probability that he will have a tooth extracted or a cavity filled
$= P(A \text{ or } B) = 0.23$

$\because P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$\Rightarrow 0.23 = 0.06 + 0.2 - P(A \text{ and } B)$

$\Rightarrow 0.23 = 0.26 - P(A \text{ and } B)$

$\Rightarrow P(A \text{ and } B) = 0.26 - 0.23$
$= 0.03$

इसलिए,

Probability that he will have a tooth extracted and a cavity filled
$= P(A \text{ and } B)$
$= 0.03$

Q. In a town of 6000 people, 1200 are over 50 years old, and 2000 are females. It is known that 30% of the females are over 50 years. What is the probability that a randomly chosen individual from the town is either female or over 50 years?

Ans: मान लिया कि
'A' denote the event that the chosen individual is female (&)

'B' denote the event that the chosen individual is over 50 years old.

दिया गया है कि :-
Town में 6000 people है
1200 50 साल से ज्यादा की उम्र के है।
2000 females है।

हमको निकालना है
Probability that a randomly chosen individual from the town is either female or male over 50 years.
= P(A or B)

{ ∵ Probability = $\frac{\text{favourable outcomes}}{\text{total outcomes}}$ }

P.T.O.

For the event A,

There are 2000 females present in a town of 6000 people.

Favourable no. of outcomes = 2000
Total no. of outcomes = 6000

$$P(A) = \frac{2000}{6000} = \frac{1}{3}$$

For the event B,

There are 1200 are over 50 years of age in a town of 6000 people.

Favourable no. of outcomes = 1200
Total no. of outcomes = 6000

$$P(B) = \frac{1200}{6000} = \frac{1}{5}$$

30% of the females are over 50 years.
For the event A and B,

$$\frac{30}{100} \times 2000 = 600$$ females are over 50 years of age.

(P.T.O.)

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Favourable no. of outcomes = 600

$P(A \text{ and } B) = \frac{600}{6000} = \frac{1}{10}$.

$\because P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\Rightarrow P(A \text{ or } B) = \frac{1}{3} + \frac{1}{5} - \frac{1}{10}$

$\Rightarrow P(A \text{ or } B) = \frac{10+6-3}{30} = \frac{13}{30}$

$\Rightarrow P(A \text{ or } B) = \frac{13}{30}$

इसलिए,

The probability that a randomly chosen individual from the town is either female or over 50 years.

$= P(A \text{ or } B)$

$= \frac{13}{30}$.